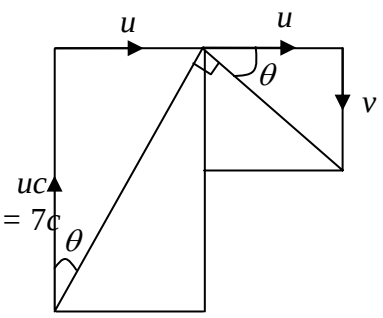
6.	(a) $\rightarrow \quad 30 = 2ut$	B1
	$\uparrow \quad -47.5 = 5ut - 4.9t^2$	M1 A1
	$-47.5 = 75 - 4.9t^2$ eliminating u or t	DM1
	$t^2 = \dfrac{75 + 47.5}{4.9} (= 25)$	DM1
	$t = 5$ ✱ cso	A1 **(6)**
	(b) $30 = 2ut \Rightarrow 30 = 10u \Rightarrow u = 3$	M1 A1 **(2)**
	(c) $\uparrow \quad \dot{y} = 5u - 9.8t = -34$ M1 requires both	M1 A1
	$\rightarrow \quad \dot{x} = 2u = 6$ $\dot{x}$ and $\dot{y}$	A1
	$v^2 = 6^2 + (-34)^2$	DM1
	$v \approx 34.5 \ (\mathrm{m\,s^{-1}})$ accept 35	A1 **(5)**
		[13]
	Alternative to (c)	
	$\frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2 = m \times g \times 47.5$ with $v_A^2 = 6^2 + 15^2 = 261$	M1 A(2,1,0)
	$v_B^2 = 261 + 2 \times 9.8 \times 47.5 \ (= 1192)$	DM1
	$v_B \approx 34.5 \ (\mathrm{m\,s^{-1}})$ accept 35	A1 **(5)**
	BEWARE : Watch out for incorrect use of $v^2 = u^2 + 2as$	

Question Number	Scheme	Marks
7.	(a) $(\downarrow)$ $u_y = 25\sin 30° \ (=12.5)$	B1
	$12 = 12.5t + 4.9t^2$ $\quad -1$ each error	M1 A2 (1, 0)
	Leading to $t = 0.743$, 0.74	A1 **(5)**
	(b) $(\rightarrow)$ $u_x = 25\cos 30° \ \left(= \frac{25\sqrt{3}}{2} \approx 21.65\right)$	B1
	$OB = 25\cos 30° \times t \ (\approx 16.094\,58)$ $\quad$ ft their (a)	M1 A1ft
	$TB \approx 1.1$ (m) $\quad$ awrt 1.09	A1 **(4)**
	(c) $(\rightarrow)$ $15 = u_x \times t \Rightarrow t = \frac{15}{u_x} (= \frac{2\sqrt{3}}{5} \approx 0.693$ or $0.69)$	M1 A1
	either $(\downarrow)$ $v_y = 12.5 + 9.8t \ (\approx 19.2896)$	M1
	$V^2 = u_x{}^2 + v_y{}^2 \ (\approx 840.840)$	
	$V \approx 29 \ (\text{ms}^{-1})$, 29.0	M1 A1 **(5)**
		[14]
	or $(\downarrow)$ $s_y = 12.5t + 4.9t^2 \ (\approx 11.0)$	M1
	$\frac{1}{2}m \times 25^2 + mg \times s_y = \frac{1}{2}mv^2$	
	$V \approx 29 \ (\text{ms}^{-1})$, 29.0	M1A1

Question Number		Scheme	Marks
6	(a)	Horizontal distance: 57.6 = p x 3 p = 19.2	M1 A1 (2)
	(b)	Use $s = ut + \frac{1}{2}at^2$ for vertical displacement.	M1
		$-0.9 = q \times 3 - \frac{1}{2}g \times 3^2$	A1
		$-0.9 = 3q - \frac{9g}{2} = 3q - 44.1$	
		$q = \frac{43.2}{3} = 14.4$ ***AG***	A1 cso (3)
	(c)	initial speed $\sqrt{p^2 + 14.4^2}$ (with their p) $= \sqrt{576} = \underline{24}$ (m s^{-1})	M1 A1 cao (2)
	(d)	$\tan\alpha = \frac{14.4}{p} (= \frac{3}{4})$ (with their p)	B1 (1)
	(e)	When the ball is 4 m above ground:	
		$3.1 = ut + \frac{1}{2}at^2$ used	M1
		$3.1 = 14.4t - \frac{1}{2}gt^2$ o.e ($4.9t^2 - 14.4t + 3.1 = 0$)	A1
		$\Rightarrow t = \frac{14.4 \pm \sqrt{(14.4)^2 - 4(4.9)(3.1)}}{2(4.9)}$ seen or implied	M1
		$t = \frac{14.4 \pm \sqrt{146.6}}{9.8}$ = 0.023389… or 2.70488… awrt 0.23 and 2.7	A1
		duration = 2.70488... − 0.23389... = 2.47 or 2.5 (seconds)	M1 A1 (6)
or 6	(e)	M1A1M1 as above	
		$t = \frac{14.4 \pm \sqrt{146.6}}{9.8}$	A1
		Duration $2 \times \frac{\sqrt{146.6}}{9.8}$ o.e.	M1
		= 2.47 or 2.5 (seconds)	A1 (6)
	(f)	Eg. : Variable 'g', Air resistance, Speed of wind, Swing of ball, The ball is not a particle.	B1 (1) **[15]**

Question Number	Scheme	Marks
Q6 (a)	$\rightarrow \quad x = u\cos\alpha t = 10$	M1A1
	$\uparrow \quad y = u\sin\alpha t - \frac{1}{2}gt^2 = 2$	M1A1
	$\Rightarrow t = \frac{10}{u\cos\alpha}$	
	$2 = u\sin\alpha \times \frac{10}{u\cos\alpha} - \frac{g}{2} \times \frac{100}{u^2\cos^2\alpha}$	M1
	$= 10\tan\alpha - \frac{50g}{u^2\cos^2\alpha}$ (given answer)	A1
		(6)
(b)	$2 = 10 \times 1 - \frac{100g \times 2}{2u^2 \times 1}$	M1A1
	$u^2 = \frac{100g}{8}$, $u = \sqrt{\frac{100g}{8}} = 11.1$ (m s^{-1})	A1
	$\frac{1}{2}mu^2 = m \times 9.8 \times 2 + \frac{1}{2}mv^2$	M1A1
	$v = 9.1ms^{-1}$	A1
		(6)
		[12]

Question Number	Scheme	Marks
Q8.	(a) $x = ut$	B1
	$y = cut - 4.9t^2$	M1 A1
	eliminating t and simplifying to give $y = cx - \frac{4.9x^2}{u^2}$ **	DM1 A1 (5)
	(b)(i) $0 = cx - \frac{4.9x^2}{u^2}$	M1
	$0 = x(c - \frac{4.9x}{u^2}) \Rightarrow R = \frac{u^2c}{4.9} = 10c$	M1 A1
	(ii) When x = 5c, $y = H$	M1
	$= 5c^2 - \frac{(5c\ )^2}{10} = 2.5c^2$	M1 A1 (6)
	(c) $\frac{dy}{dx} = c - \frac{9.8x}{u^2} = c - \frac{x}{5}$	M1 A1
	When x = 0, $\frac{dy}{dx} = c$	B1
	So, $c - \frac{x}{5} = \frac{-1}{c}$	DM1 A1
	$x = 5(c + \frac{1}{c})$	A1 (6)
		[17]
	Alternative to 8(c)  $\tan\theta = \frac{u}{cu} = \frac{1}{c} = \frac{v}{u}$	B1
	$\Rightarrow v = \frac{u}{c} = \frac{7}{c}$	M1 A1
	$v = u + at$; $-\frac{7}{c} = 7c - 9.8t$	M1
	$t = \frac{7}{9.8}(c + \frac{1}{c})$	A1
	$x = ut = 7t$; $x = 5(c + \frac{1}{c})$	A1

Question Number	Scheme	Marks
Q7 (a)	Vertical motion: $v^2 = u^2 + 2as$ $(40\sin\theta)^2 = 2 \times g \times 12$ $(\sin\theta)^2 = \frac{2 \times g \times 12}{40^2}$ $\theta = 22.54 = 22.5°$ (accept 23)	M1 A1 A1 (3)
(b)	Vert motion $P \to R$: $s = ut + \frac{1}{2}at^2$ $-36 = 40\sin\theta t - \frac{g}{2}t^2$ $\frac{g}{2}t^2 - 40\sin\theta t - 36 = 0$ $t = \frac{40\sin 22.54 \pm \sqrt{(40\sin 22.54)^2 + 4 \times 4.9 \times 36}}{9.8}$ $t = 4.694...$ Horizontal P to R: $s = 40\cos\theta t$ $= 173$ m (or 170 m)	 M1 A1 A1 A1 M1 A1 (6)
(c)	Using Energy: $\frac{1}{2}mv^2 - \frac{1}{2}m \times 40^2 = m \times g \times 36$ $v^2 = 2\left(9.8 \times 36 + \frac{1}{2} \times 40^2\right)$ $v = 48.0.....$ $v = 48$ m s^{-1} (accept 48.0)	 M1 A1 A1 (3) **[12]**